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PN-AAH-571

A DEVELOPMENT PLAN FOR FRESH WATER FISHERIES IN THE HAN RIVER BASIN

KANGWON PROVINCIAL GOVERNMENT

CHUNCHON KOREA

N-AAH-501

A DEVELOPMENT PLAN

For Fresh Water Fisheries In The Han River Basin

Printed by

COMMUNICATIONS MEDIA BRANCH

UNITED STATES OPERATIONS MISSION TO KOREA

C O N T E N T S

May 25, 1965

PREFACE

The North Han River basin lies almost entirely in Kangwon Province. This province with many industrial, agricultural, fishery and tourism resources is in the central eastern portion of Korea. The province is 82 per cent mountainous and has 135 miles of seacoast along the East Sea. Our province has a plan to develop new income possibilities for our citizens both in the mountains and along the seacoast.

Our earlier ideas of fishery production were limited only to sea fishing. In our present plans we are intending to utilize artificial fish apartments for salt water fish and are using cultivation techniques in the production of dulse and agar-agar in tidal areas.

This report covers a new proposal for development of fresh water fisheries in the Han River basin. This development, if accomplished, will greatly assist the income of rural people living in the area involved. Much of this area is in the north of the province and is close to the Armistice Line. The rural people in this area need badly the additional financial resources possible through inland fish culture.

I wish to acknowledge the help and assistance in preparation of this report by the Fisheries Bureau, Ministry of Agriculture and Forestry, the Republic of Korea Government and the Fisheries Section of the Industry Bureau of Kyonggi Provincial Government. I also wish to thank Mr. L. Wakefield, Fisheries Advisor, and Mr. W. H. Johnson, Kangwon Do Advisor, of the Rural Development Division, United States Operations Mission to Korea, for encouraging our efforts and assisting us to develop many fresh ideas for our consideration.

Pak, Kyong Won
Governor
Kangwon Province
Republic of Korea

A. Introduction

1. General Information

(a) Geographical location

The Han River basin system consists of two main rivers, the North Han and the South Han. This report is concerned with the reservoirs on the North Han which, with the exception of the western land of Chongpyong reservoir, are all in Kangwon Province. This province is in the central eastern part of Korea and it is the largest province in Korea.

The South Han River originates in the Taeback Mountain range in southern Kangwon Province and traces a course through Kangwon Do, Chungchong Puk Do and Kyonggi Do enroute to a junction with the North Han in Kyonggi Do. The combined streams travel through Seoul and to the Yellow Sea at Inchon. Since no reservoirs now exist on the South Han, this report makes no recommendations in this region.

(b) Terrain

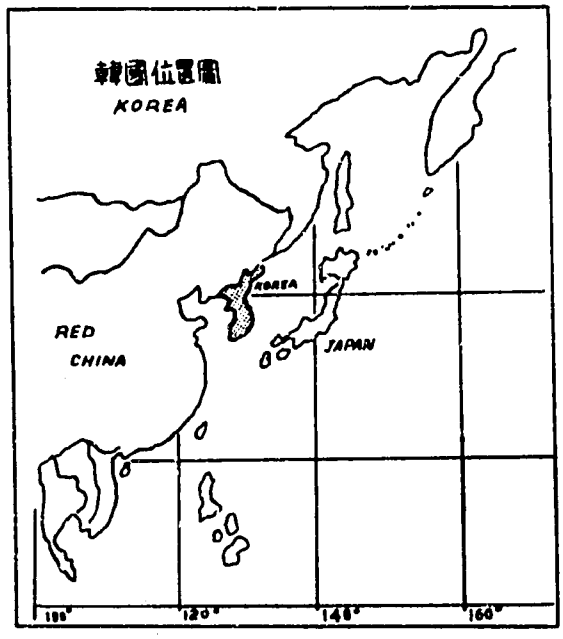
(i) Area and its pattern (see plate No. 1)

Land south of the Armistice Line in Kangwon Province totals 16,618.2 square kilometers. Most of this area contains high mountains. The area is 82 per cent mountainous and 18 per cent flatland. The pattern of this area can be classified as follows:

Low-land area (less than 100 meters above sea-level)	5.6 %
Moor and hill (100-500 meters above sea-level)	42.1 %
Mountainous area (500-1,000 meters above sea-level)	43.6 %
High mountainous area (above 1,000 meters over sea-level)	7.6 %

(ii) Rivers and lakes

Because of the mountainous terrain, many rivers and lakes originate in the province, and many of these are utilized for water conservation and agricultural irrigation. The major rivers and the climate of the province are shown as follows:



LOCATION OF KANGWON PROVINCE

江原道位置圖

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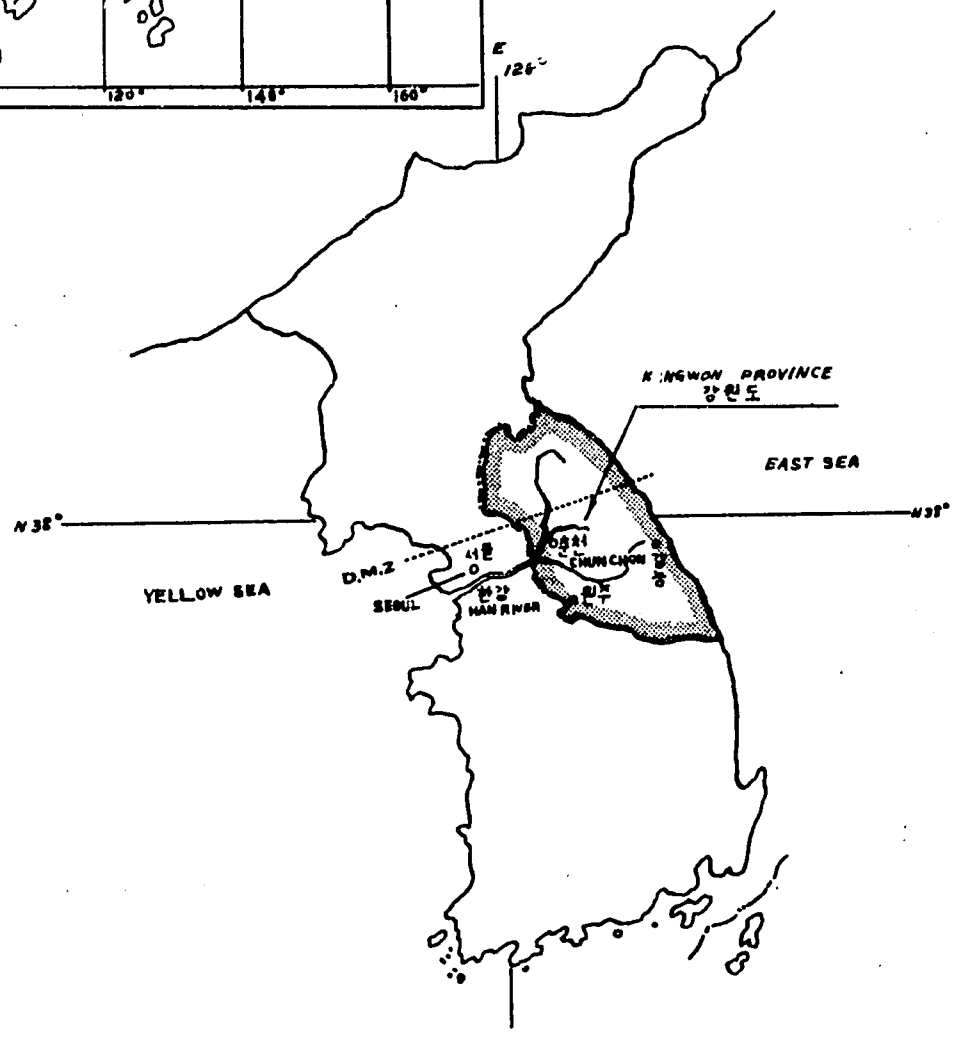


Rivers and Lakes

	Number	Area (sq.km)	Length (km)
Rivers	249	30,420.3	3,546
Lakes	7	6,270	
Reservoirs (for power)	4	85,122	
Reservoirs (irrigation)	32	5,990	

Climate

Year	Temperature (°C) Average	Highest	Lowest	Total Rain Fall (mm)	Average Humidity (%)	Average Wind Velocity (MPH)
1961	11.1	16.9	5.9	1,451.8	76	2
1962	10.2	15.9	5.6	1,084.8	74	6
1963	9.3	15.1	4.3	1,682	75	4

Weather

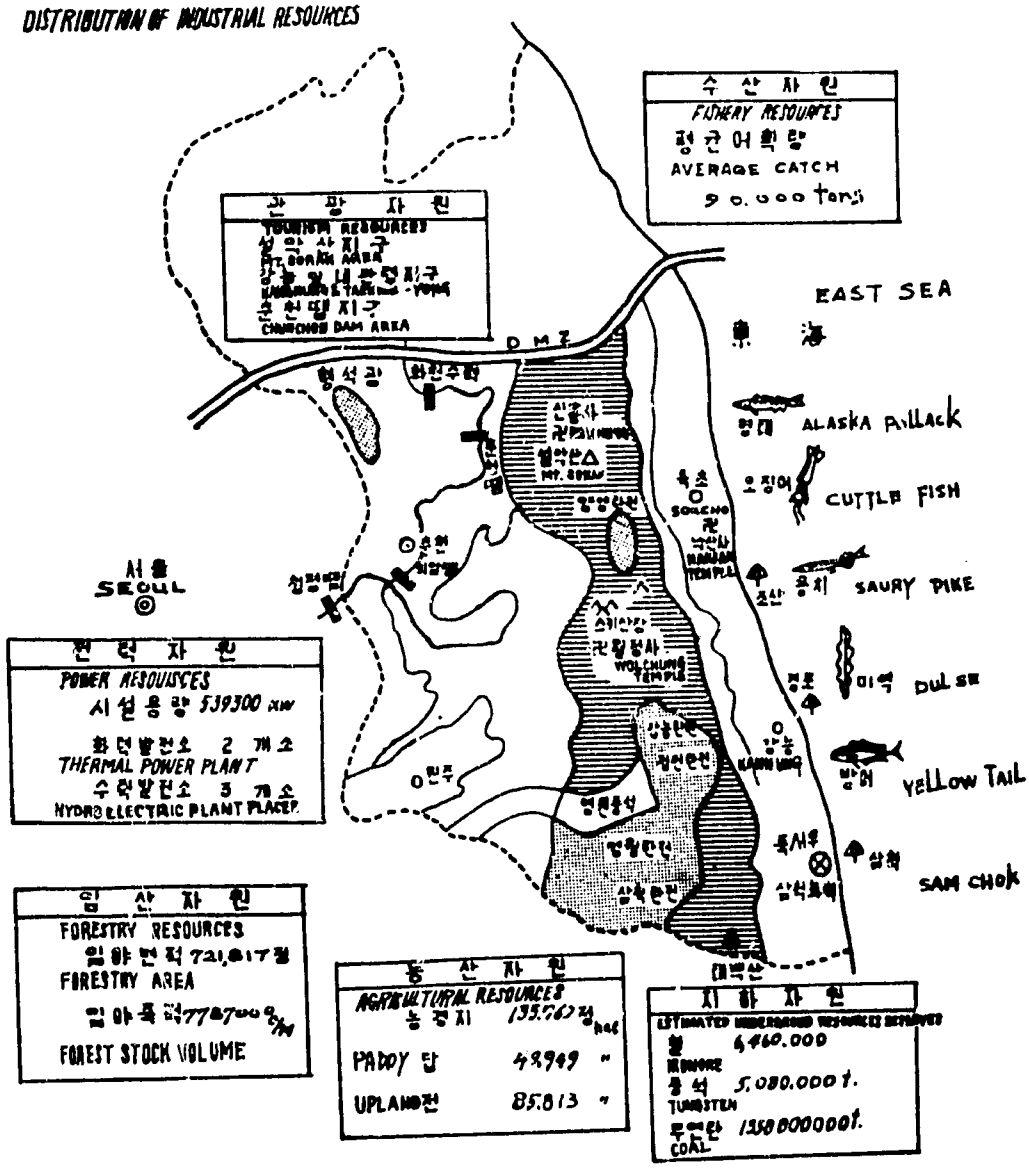
Year	Clear	Cloudy	Frost	Haze	Snow	Thunder Storms	Major Storms
1961	210	99	103	155	11	5	1
1962	194	114	91	115	25	4	6
1963	177	120	70	70	17	2	4

(c) Population

(i) Population in the Han River basin (Kangwon Do unless noted)

産業資源分布圖

DISTRIBUTION OF INDUSTRIAL RESOURCES



City or County	Total	Male	Female
Chunchon City	90,802	45,123	45,679
Chunsung	86,764	44,441	42,323
Hongchon	126,577	64,245	62,332
Hwachon	51,719	26,182	25,537
Yangku	35,914	18,323	17,591
Inje	57,587	29,346	28,241
*Kapyoung	71,071	35,793	35,278
Total	617,174	312,305	304,869

2. Inland Fisheries

(a) Distribution of rivers and lakes

(i) Rivers

**Type of Rivers	Number	Area (sq.km)	Length (km)
National rivers	3	299.8	123.3
Provincial rivers	12	14,060.6	651.9
Local rivers	234	16,059.9	2,770.8
Total	247	30,420.3	3,546

(ii) National Rivers

Name of River	Origin	Termination	Area (sq.km)	Length (km)
Sum River	Jijung Myon, Wonsung Gun	Han River	84.6	12.5
North Han River	Hwachon Myon, Hwachon Gun	Han River	179.8	95
Soyang River	Dong Myon, Chungsung Gun	North Han River	34.4	15.8

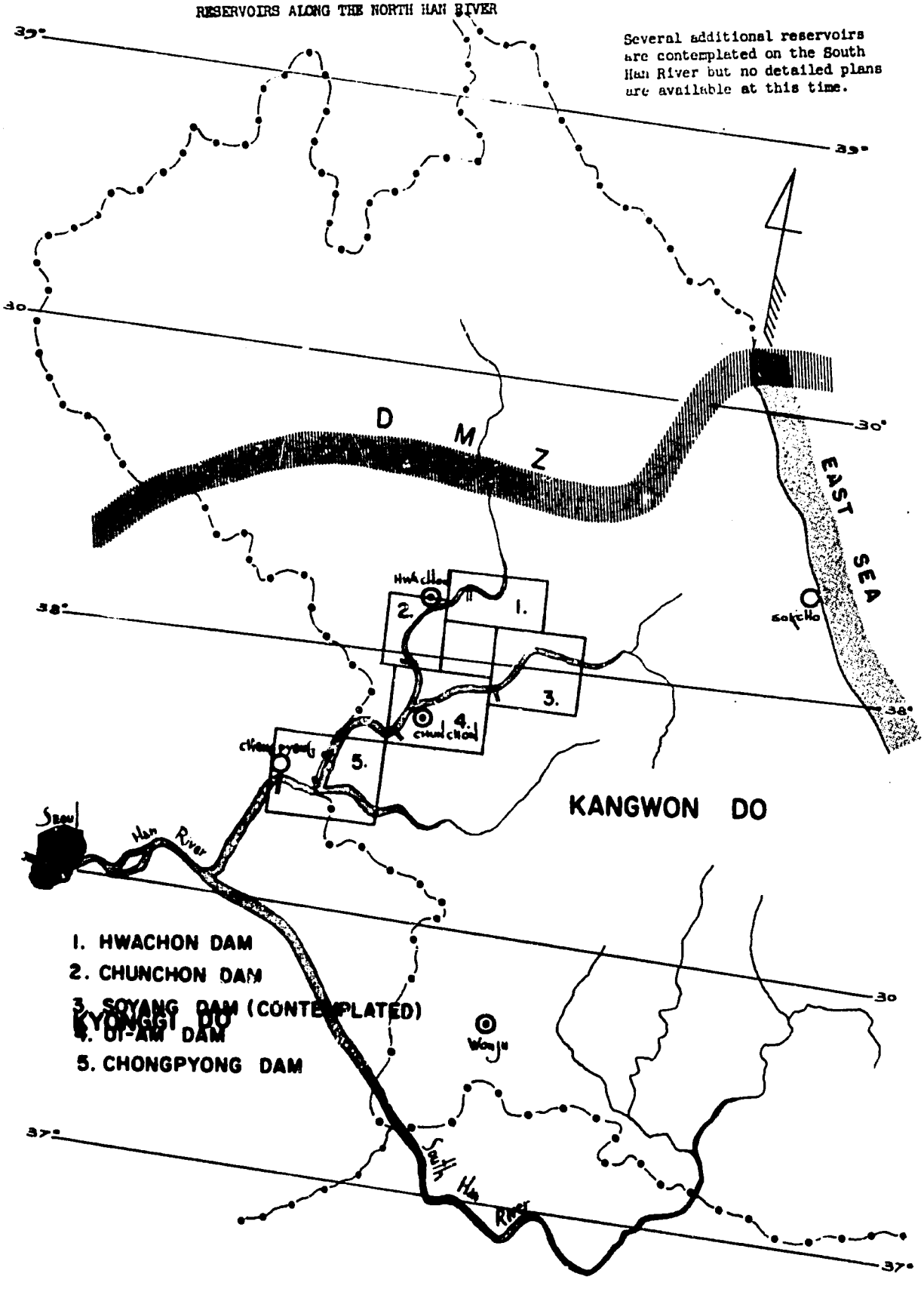
* Kyonggi Province
** Administrative Designation

北漢江流域發電用貯水池位置図

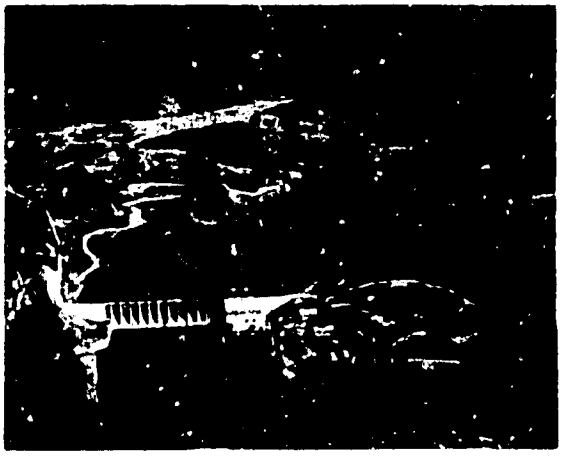
RESERVOIRS ALONG THE NORTH HAN RIVER

$S = \frac{1}{750,000}$

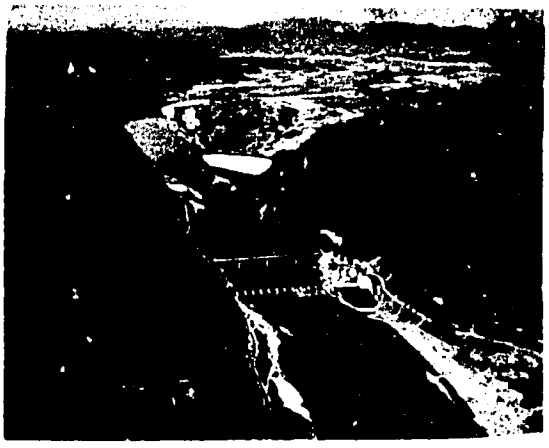
Several additional reservoirs are contemplated on the South Han River but no detailed plans are available at this time.



1. HWACHON DAM



2. CHUNCHON DAM



4. UI-AM DAM

5. CHONGPYONG DAM

(iii) Provincial rivers

Name of river	Origin	Termination	Area(sq.km)	Length(km)
Han River	Puk Myun, Jungsun Gun	Boundary of Chungchong Puk Do	4,246.7	107
Pyungchang River	Pyungchang Myun, Pyungchang Gun	Han River	1,654.4	91.5
Sum River	Hwengsung Myun, Hwengsung Gun	Sum River	1,027	41.3
* North Han	Ahnpyung Myun, Hweyang Gun	Han River	1,040	49.8
* Soyang River	Inje Myun, Inje Gun	Soyang River	2,350	88.7
* Inpuk River	Sohwa Myun, Inje Gun	Soyang River	654.1	20.8
* Hongchon River	Naechon Myun, Hongchon Gun	Soyang River	1,320	101
Hantan River	Cholwon Gun		370	21
Namdaichon River	Kundong Myun, Cholwon Gun	Hantan River	321.4	20
Onsipchon River	Sodal Myun, Samchok Gun	East Coast	378.4	48
Mandaichon River	Wangsan Myun, Myungju Gun	East Coast	208.6	28
Namdaichon River (Yangyang)	Hyungpuk Myun, Yangyang Gun	East Coast	490	28.8

(iv) Reservoirs (see the plate No.3)

(1) Hwachon Reservoir

The water surface area is 36,327 square kilometers and is located in the area of Kandong Myon, Hwachon Gun, Kangwon Province. The river

* Rivers within the North Han Watershed area.

on which this reservoir is located flows from the northern part of the province, across the DMZ and passes through Cholwon and Yangku. The reservoir was constructed in 1942.

(2) Chunchon Reservoir (see the plate No. 6)

The water surface area is 14,320 square kilometers and is located in the area of Sinpuk Myon, Chunsung Gun of Kangwon Province. The reservoir stores water flow from the Hwachon Reservoir and the Jichon River (which originates in Sanae Myon, Hwachon Gun). The reservoir was constructed in February 1965.

(3) Uiam Reservoir (see the plate No. 7)

The water surface area will be 16,875 square kilometers and is located in Sindong Myon, Chunsung Gun of Kangwon Province. The reservoir stores water which flows from the Chunchon Reservoir and the Soyang River (originating in Inje Myon, Inje Gun). The reservoir is under construction and will be completed by December 1965.

(4) Chongpyong Reservoir (see the plate No. 7)

The water surface area is 17,600 square kilometers and is located in the area of Oeso Myon, Kapyung Gun, Kyonggi Do Province. This reservoir which stores water flows from Uiam reservoir and the Hongchon River (originating from Naechon Myon, Hongchon Gun of Kangwon Province) and was constructed in July 1943.

(5) Soyang Reservoir (see the plate No. 3)

This reservoir will be located near the junction of the Soyang River and the North Han River. The water area is estimated to be 31,000 square kilometers. This reservoir is considered as part of the plan of the national 5-year economic development program.

(v) Natural Lakes

The following lakes are located along the East Coast and the quality of water is mostly brackish. These lakes are not involved in this development plan.

Name of Lake	Location	Area(sq.km)
Songji Lake	Jukwang Myon, Kosung Gun	495
Mai Lake	Hyunnam Myon, Yangyang Gun	198
Hyang Lake	Jumunjin Eup, Myungju Gun	495
Kyungpo Lake	Kangnung City	1,287
Hwajinpo Lake	Kojin Myon, Kosing Gun	2,310
Yongrang Lake	Tosung Myon, Kosung Gun	990
Chungcho Lake	Sokcho City	495
	Total	6,270

(b) Culture of Fresh Water Fish

(i) National Status

As of the end of 1962, only 68 families have engaged in the culture of fresh water fish throughout Korea. They are raising carp, crusain carp and loach. Their is a prospect for eel culture based upon a demand for high nutritive value products. Other possibilities include raising other economic fish such as white salmon.

The necessary guidance activity for fresh water fish culture is managed by the National Fishery Development Office for the overall program. The species support and the technical assistant to the persons engaged in the culture is provided by the Jinhae Fresh Water Fish Hatchery for the southern part of Korea and the Chungpyung fish hatchery for the northern section. These two hatcheries to date have been cultivating principally carp.

Status of the Fresh Water Fish Culture (National)
(as of December 31, 1962)

No. of households engaged	Culture in Ponds		Culture in Paddies		Culture by Reservoir	
	No.of Places	Area (sq.km)	No. of Places	Area (sq.km)	No. of Places	Area (sq.km)
68	187	193	45	312	43	951

(ii) Provincial (Kangwon Province)

At the end of 1964, only 6 families have participated in the culture carp and cat fish. Fresh water fish culture is an underdeveloped area today. The provincial government has emphasized fresh water fish culture, particularly economic fish such as cat fish or trout. For a portion of this project, 10,000 spawn of rainbor trout was donated by Mr. H. Clineshmidt, President of the California State Fish and Game Commission, California, U.S.A. on January 3, 1965. They have been successfully hatched at the Provincial Fish Hatchery located near the Hwachon Reservoir, Kumanri, Kandong Myon, Hwachon Gun. When expansion of facilities of the provincial hatchery is carried out, another import of rainbow trout will be considered to permit continual distribution for release to the main rivers in the province.

B. Development Plan

1. General conditions

Several reservoirs now developed will make it possible for fresh water fish culture along the North Han River. The surrounding area is not developed for mining and industrial purposes which could cause demage in fresh water fish culture.

(a) Area, Water volume and depth of reservoirs

Reservoir	Area(sq.km)	Maximum depth (m)	Water volume (approximately,cu. meters)
Hwachon	36,327	80	314,390
Chunchon	14,320	33	150,000
Uiam	16,875	17	78,000
Chongpyong	17,600	31	186,000

(b) Stream Flow of the North Han River at Chungpyong reservoir

Stream Flow into the Chungpyong reservoir
(m^3/sec.)

1962	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average	104	108	115	199	97	99	165	824	443	117	101	93
Maximum	112	123	133	569	150	152	807	1,762	698	114	125	112
Minimum	89	96	87	98	64	70	131	366	157	74	84	54
1963												
Average	70	68	64	645	286	583	1,900	385	127	87	73	54
Maximum	94	107	103	1,675	2,054	2,564	6,628	869	203	115	121	76
Minimum	20	30	30	179	156	130	346	204	79	25	30	34
1964												
Average	53	43	57	1,025	336	219	1,944	1,271	824	161	82	35
Maximum	73	81	85	3,594	1,349	1,026	5,641	10,100	2,581	383	137	187
Minimum	17	16	33	186	132	141	215	164	266	66	20	6

Source: Statistics of Electric Power in Korea published by Korea Electric Company

(c) Monthly Water Temperature by Reservoir (°C)

(i) Hwachon Reservoir

1963	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Highest	7.0	3.0	7.0	12.5	20.5	24.0	27.0	28.0	26.0	22.0	17.0	
Lowest	2.0	2.0	2.0	6.0	12.2	20.5	23.0	26.0	22.0	17.5	11.0	
Average	4.3	2.4	4.2	8.6	17.1	22.0	25.3	26.7	24.1	19.1	14.5	
1964												
Highest	8.0	5.0	7.0	14.0	22.0	26.0	27.0	28.0	26.0	21.0	17.0	13.0
Lowest	4.5	1.0	2.0	5.0	13.0	22.0	22.5	26.0	20.0	16.5	12.0	8.0
Average	5.4	3.5	4.1	10.3	18.7	23.7	25.5	26.8	24.0	18.1	14.5	10.8

(ii) Chongpyong Reservoir

1963	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Highest	1	0	4	10	16	19	20	24	23	19	13	8
Lowest	-1	-1	1	4	10	16	20	20	19	13	8	-1
Average	0	-0.9	2.2	8.3	13.8	17.5	20	22.6	20.8	16.0	11.5	4.7
1964												
Highest	1.5	1.5	3	10	19	19	23	24	24	18	13	6
Lowest	0	0	1	4	10	18	19	22	18	13	7	3
Average	-0.7	0.8	1.9	7.3	13.9	17.8	18.4	23.2	20.6	15.6	10.0	4.3

(d) Daily Air Temperature and Rainfall at the Reservoirs

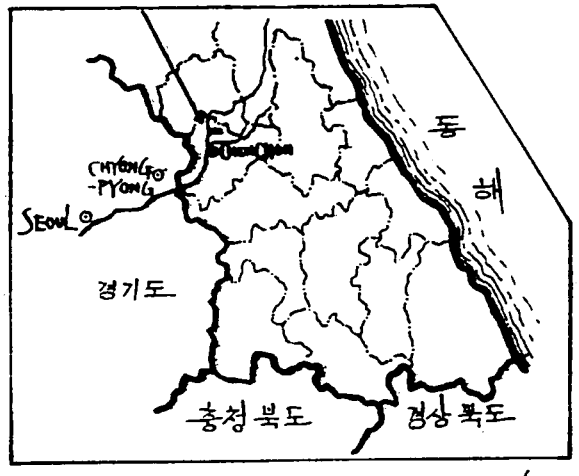
(i) Hwachon Reservoir

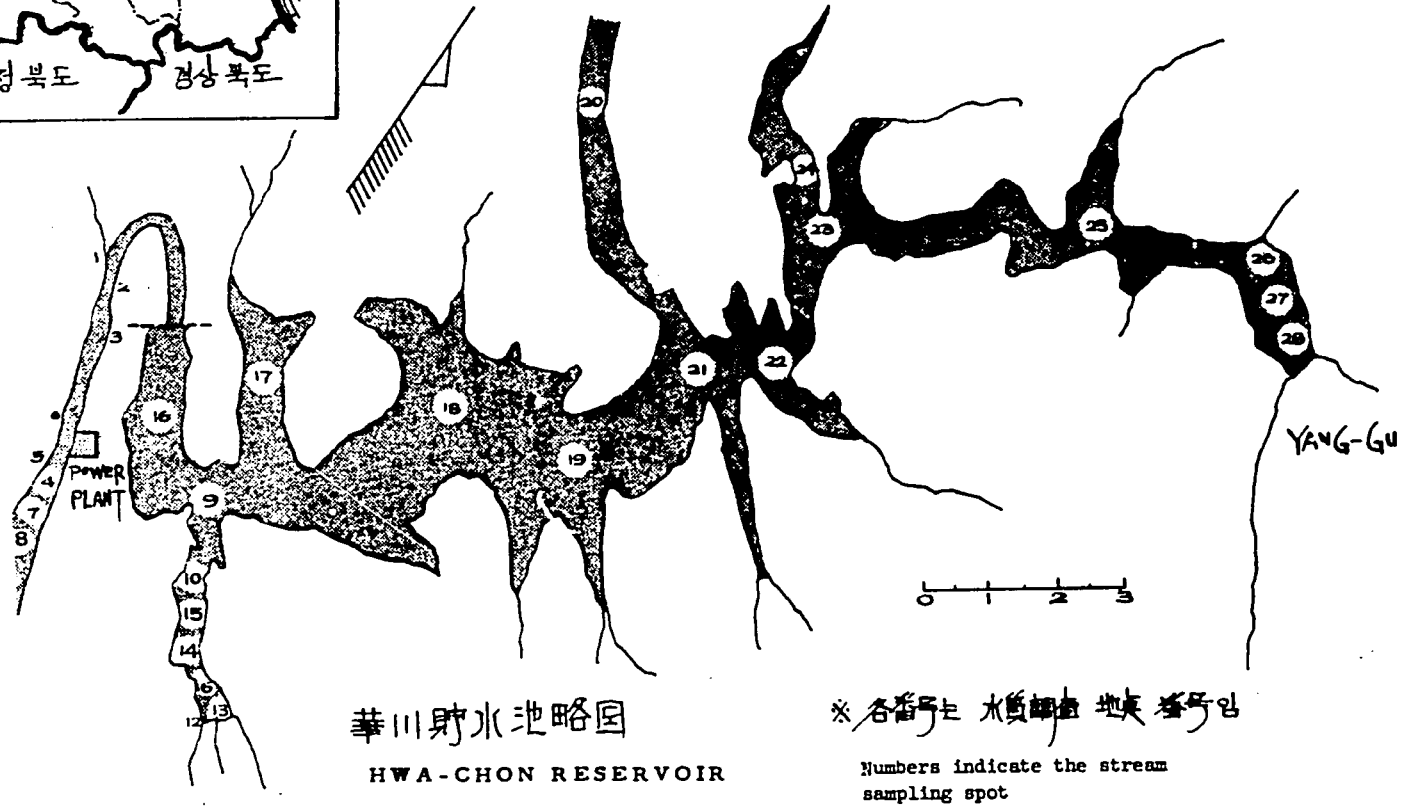
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1963													
Average Temperature (c)		-5.9	3.2	10.6	16.9	20.5	24.4	25.0	18.7	11.1	3.9	-1.7	
Average Rainfall (mm)	10.6	6.0	54.9	189.1	195.5	277.9	546.5	145.8	41.8	6.0	19.6	23.2	
Clear days		13	13	10	9	11	5	11	15	19	13	13	134
Rainy days			3	13	14	12	21	10	7	3	10	3	95
Snowy days		10	7	3							2	8	30
Cloudy days		5	9	5	8	7	5	10	8	9	5	7	80
1964													
Average Temperature (c)	-3.4	-6.4	2.6	12.1	18.5	21.5	24.4	25.6	18.6	11.3	4.3	-3.2	
Average Rainfall (mm)	23.3	15.4	43.3	339.9	85.3	83.3	408.1	408.1	205.6	49.2	9.9	9.4	
Clear days		12	16	9	16	13	8	9	7	14	11	16	137
Rainy days			2	16	6	13	11	16	15	5	7	1	101
Snowy days	8	10	5								1	7	31
Cloudy days	8	6	7	5	9	4	5	6	8	12	11	7	88

(ii) Chongpyong Reservoir

	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1963													
Average Temperature(°C)	-9.7	-3.4	6.5	11.3	21.8	24.4	26.5	28.8	22.7	14.1	6.4	0.004	
Average Rainfall(mm)	9.2	6.7	50.6	254.9	227.2	487.1	662.3	135.2	41.8	24.2	21.2	14.2	
Clear days	25	19	22	9	9	10	7	11	19	23	13	10	177
Rainy days			1	7	7	6	8			1	1	2	34
Snowy days		2	1										3
Cloudy days	6	7	7	14	15	14	16	19	11	7	16	19	151
1964													
Average Temperature(°C)	-0.5	-5.1	6.1	14.2	21.7	22.6	27.2	28.0	22.0	14.1	5.9	-2.5	
Average Rainfall(mm)	50.8	33.4	38.9	437.8	85.5	97.8	525.4	561.4	354.9	45.2	10.2	10.2	
Clear days	16	21	20	12	15	14	9	15	8	15	17	17	179
Rainy days	1			8	4	3	9	5	7	2			39
Snowy days	4	3									2	2	11
Cloudy days	10	5	11	10	12	13	13	11	15	14	11	12	137

춘천땜 위치





華川貯水池略図

HWA-CHON RESERVOIR

※各番号は水質調査地点番号です

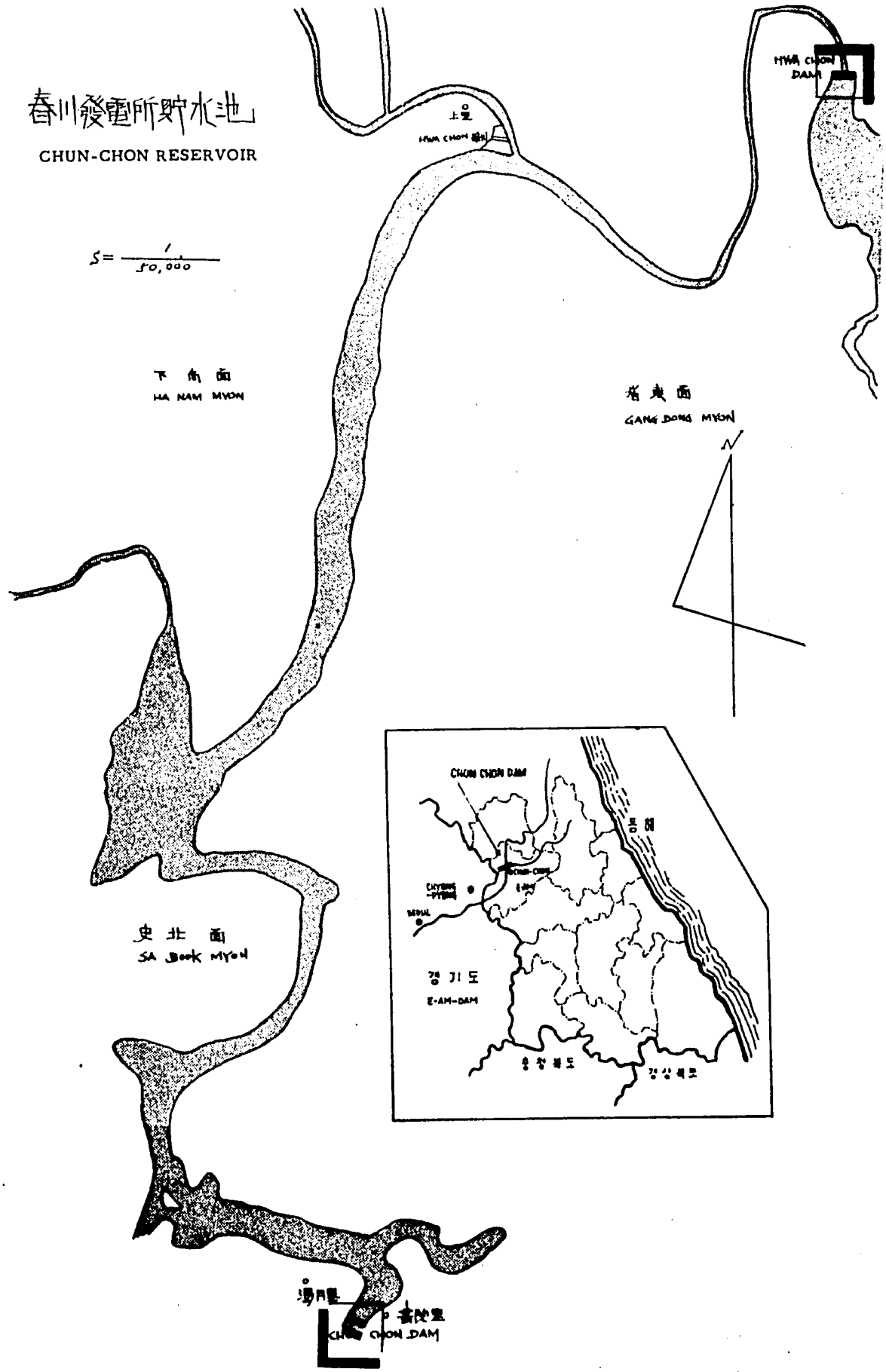
Numbers indicate the stream sampling spot

iii) TEMPERATURE AT VARIOUS LOCATION IN THE HWACHON RESERVOIR (For Locations See Plate No. 5)

LOCATION NO.	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	AVERAGE
DEPTH (m)	56	24	4	25	4	7	19	56	26	52	48	49	49	18	40	38	18	6	6	3	
DATE	8/10/58	"	"	"	"	"	"	8/13	8/18	"	"	8/19	8/19	"	"	"	"	"	"	"	
	10:25	13:00	15:00	15:35	15:40	16:00	16:35	11:30	13:00	15:00	17:00	7:00	9:00	12:00	12:00	15:00	16:30	17:30	18:30	18:30	
TEMPERATURE (°c)	27.3	28.6	27.6	27.0	27.0	30.0	26.0	22.5	25.0	29.5	32.5	22.5	24.0	24.5	30.5	30.0	30.0	26.0	26.0	24.0	25.6

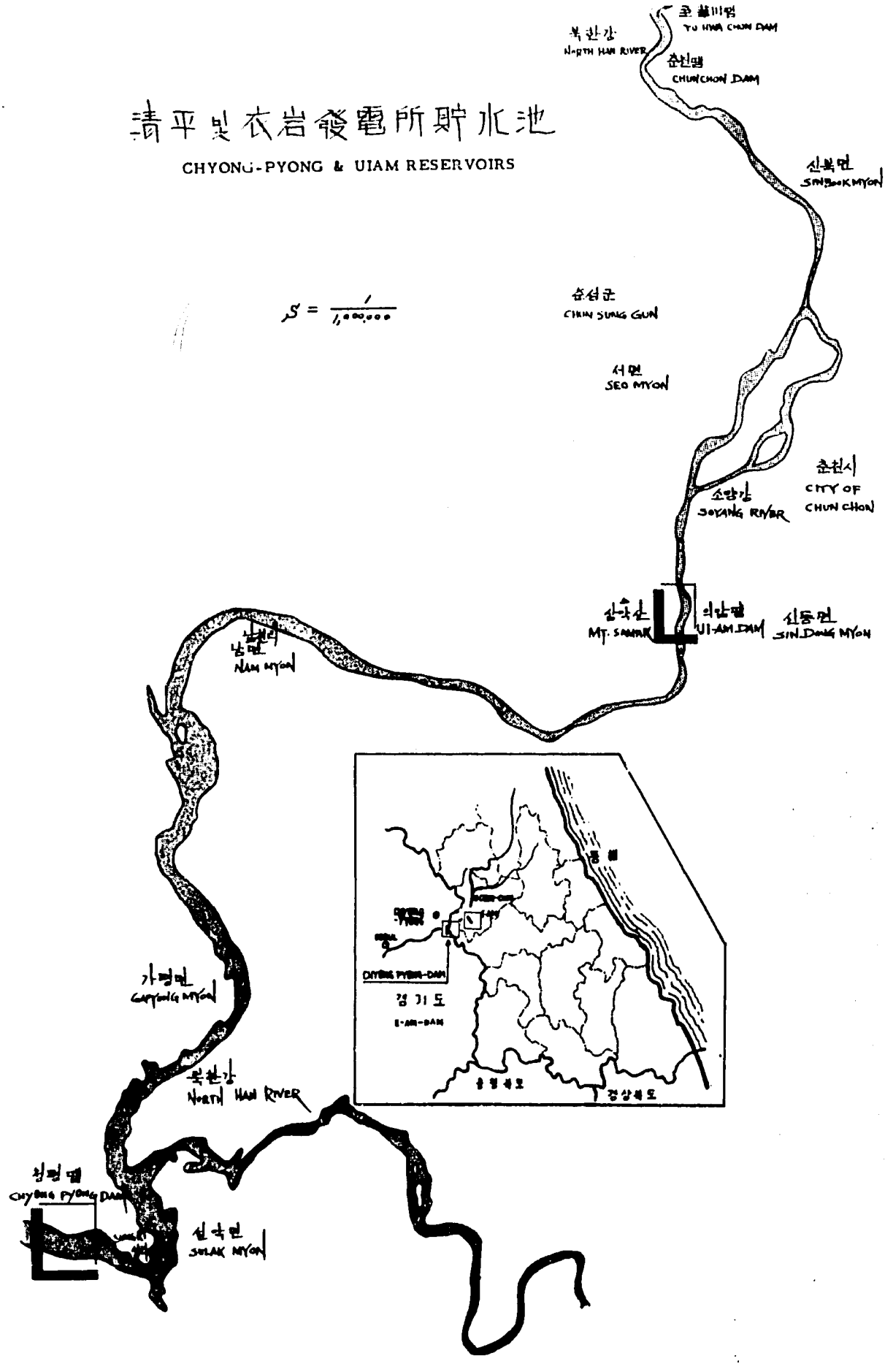
WATER TEMPERATURE READINGS (°c) PLOTTED AGAINST DEPTH

LOCATION NO.	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	AVERAGE
1 m	28.8	27.3	28.0	28.0	29.3	29.5	28.0	25.5	27.0	28.5	28.5	25.5	25.5	25.1	27.0	27.5	28.0	28.8	29.0	29.0	27.7
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.8	26.8
4	-	-	26.7	-	26.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.5
5	-	-	-	-	-	-	-	-	25.3	-	24.7	-	-	-	-	-	-	23.7	-	-	24.6
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.3	-	22.3
10	-	-	-	-	-	-	-	20.6	-	-	21.5	-	-	-	-	21.5	21.5	-	-	-	21.3
15	-	-	-	-	-	-	20.5	-	20.5	20.5	-	-	20.1	19.8	20.0	-	-	-	-	-	20.2
20	18.9	20.5	-	-	-	-	-	-	-	-	19.5	19.0	-	-	-	-	-	-	-	-	19.5
25	-	-	-	-	-	-	-	-	19.5	-	-	-	18.7	-	-	-	-	-	-	-	19.1
30	-	-	-	-	-	-	-	17.7	-	12.8	-	-	-	-	-	18.0	-	-	-	-	16.2
35	-	-	-	-	-	-	-	-	-	-	5.8	-	11.0	-	15.0	16.5	-	-	-	-	13.0
40	6.5	-	-	-	-	-	-	-	-	-	5.8	5.2	-	-	-	-	-	-	-	-	5.8
45	-	-	-	-	-	-	-	-	-	5.5	-	-	-	-	-	-	-	-	-	-	5.5
50	-	-	-	-	-	-	-	4.5	-	-	-	-	-	-	-	-	-	-	-	-	4.5


春川發電所貯水池
CHUN-CHON RESERVOIR
S= 1/50,000
HWA CHON DAM
上里
HWA CHON 驛
下南面
HA NAM MYON
嘉東面
GANG DONG MYON
N
CHUN CHON DAM
CHUNG-CHEON
SEOUL
경기도
E-AM-DAM
史北面
SA BOOK MYON
CHUN CHON DAM

淸平및衣岩發電所貯水池

CHYONG-PYONG & UIAM RESERVOIRS



(iv) Water Temperature by Depth

Reservoir	Date & Time of survey	Air Temper.	Surface	Water Temperature 1 m	2 m	3 m	4 m	6 m	8 m	10m	12m
Hwachon	15:30, April 20, 1965	18.0 C	12.4	11.0	10.4	8.7	8.0	7.7	7.5	9.3	7.3
Chongpyong	15:00, April 21, 1965	17.3 C	13.3	12.7	12.7		12.7	12.0	12.4	11.8	9.8

(e) Characteristics of the Water in the Reservoirs

(i) O_2 content in the Hwachon Reservoir (August 1958)

Location No.	9 (mg/l)	16 (mg/l)	21 (mg/l)	23 (mg/l)	26 (mg/l)	28 (mg/l)	Average (mg/l)
2 m	-	-	-	-	-	4.69	4.69
5 m	-	-	-	-	4.87	-	4.87
10 m	-	4.92	-	-	-	-	4.92
15 m	-	-	-	4.82	-	-	4.82
20 m	5.02	-	-	-	-	-	5.02
30 m	-	5.36	-	-	-	-	5.36
35 m	-	-	4.47	-	-	-	4.47
40 m	4.99	-	-	-	-	-	4.99
50 m	-	5.46	-	-	-	-	5.46
Average	5.00	5.25	4.47	4.82	4.87	4.69	4.96

Depth

(ii) pH content at the Hwachon Reservoir (August 1958)

Location No.		9	10	13	14	15	16	17	18	19	20	21	23	25	26	28	Average
Depth	1 m	7.0	6.4	6.6	6.6	6.6	6.8	6.8	6.8	6.8	6.8	7.0	6.8	7.0	6.6	6.6	6.75
	2 m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.8	6.8
	5 m	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6	-	6.6
	6 m	-	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-	6.6
	10 m	-	-	-	-	-	6.8	-	-	7.0	-	-	-	-	-	-	6.9
	15 m	-	-	-	-	6.6	-	-	-	-	-	-	-	-	-	-	6.6
	20 m	6.6	6.4	-	-	-	-	-	-	6.8	-	-	-	-	-	-	6.6
	25 m	-	-	-	-	-	-	-	-	-	-	7.0	-	-	-	-	7.0
	30 m	-	-	-	-	-	6.8	-	-	-	-	-	-	-	-	-	6.8
	35 m	-	-	-	-	-	-	-	-	-	-	6.8	6.8	-	-	-	6.8
	40 m	6.4	-	-	-	-	-	-	-	6.8	-	-	-	-	-	-	6.6
	50 m	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-	-	6.6
Average		6.6	6.4	6.6	6.6	6.6	6.7	6.7	6.8	6.8	6.8	6.9	6.8	7.0	6.6	6.8	6.74

(iii) Chemicals Found in Significant Quantities in the Hwachon Reservoir August 1958

Type of Chemicals	Depth (Units in mg/l) 1 - 10 m	11 - 30 m	31 - 50 m	Average
Cl	21.42	19.89	16.30	19.20
N	23.10	33.04	29.80	28.65
N_2S	5.95	8.33	10.37	8.22
Si O_2	16.9	9.9	12.9	13.24
Fe	0.0037	0.0044	0.0030	0.0036
P_2O_5	9.52	8.62	9.96	7.69
Organic Matter	43.25	56.97	60.05	53.42

(iv) Color and Transparency at Various Depths at the Hwachon Reservoir August 1958

Location No.	9	10	14	15	16	17	18	19	20	21	23	24	25	26	27	28	Average
Depth(m)	56	24	7	19	56	26	52	48	49	49	40	38	18	6	6	3	
Color(m)	5	5	7	7	5	6	6	6	6	6	7	7	6	7	7	7	6
Transparency (m)	1	4.8	3.5	4.5	6	5.5	5.5	5.5	5.5	4.9	4.8	5	3.5	2.9	2.9	2.9	4.8

(v) Plankton Content of the Hwachon Reservoir

Number of locations of Samples 4

Date of Collection ..... August, September, November, December 1958

Water Velocity ..... 1 meter per Second

Type of Bottom ..... Gravel

Sample Size ..... 21,195 litres

Number of Plandkton colleoted 31.3

Plankton remaining after filtration.. 0.7 cc

Water Temperature ..... 18.0 (c)

(1) Animal Plankton

	Name of Plankton	Quantity	%
1.	Daphnia longispina	1,000	2.0
2.	D. Pulex	600	1.2
3.	Basmina Longirotris	2,000	4.0
4.	Mess. Cyclops Oithonoides	600	1.2
5.	Cyclops Staenus	400	0.8
6.	Deatomus Spp.	400	0.8
7.	Copepoda's Larva	400	0.4
	Sub-Total	5,200	10.4
8.	Asplachana Sp.	200	0.4
9.	Ceratium Herunolinella	3,000	6.0
10.	Centropyxio Aculeata	3,400	6.9
11.	Difflugia Sp.	800	1.6
12.	Opercuiaria Nutaus	4,000	8.0
	Sub-Total	11,200	22.5
	Total	16,600	23.4

(2) Vegetable Plankton

13.	Cymbella Spp.	2,000	4.0
14.	Amphora Spp.	3,400	6.9
	Sub-Total	5,400	10.8
15.	Closterium Cynthia	3,600	7.3
16.	Closterium Sp.	2,800	5.6
17.	Cladophora Sp.	800	1.6
18.	Spiragyra Sp.	1,200	25.0
19.	Siendesmus Spp.	200	0.4
20.	Ulothrix Sp.	4,000	8.0
21.	Prasiola Crispa	8,500	17.2
22.	Hicrospora Sp.	6,100	13.2
	Sub-Total	27,800	55.8
	Total	33,200	66.6
	Grand Total	49,800	100.

Source: From a report by Professor Kim Eul Bae, Pusan Fisheries College.

(f) Fish species found in the North Han River

(i) Cyprinidae Family

	Korean name	Scientific name	English name
1.	Eng-O	Cyprinus carpio	Carp
2.	Bung-O	Carassius auratus	Crusian Carp
3.	Olumchi	Gonoproktopterus mylodon	-
4.	Nuchi	Hemibarbus farbus	Cornet fish
5.	Chammaja	Hemibarbus longirastris	-
6.	Pilaemi	Zacco. platypus	-
7.	Molemochi	Pseudogobio esocinus	Yoby Minnow
8.	Kuguli	Gobio botla microcephalus	-
9.	Kuli	Opsariichthys bidens	Notch jaw
10.	Dolmaja	Micro physogobio yaluensis	-

(ii) Serranidae Family

11.	Kukohi	Corespora herzi	-
12.	Sogari	Siniperca scherzeri	Mandarin fish

(iii) Bagridae Family

13.	Maegi	Parasilurus asotus	Cat fish

(g) Fish Hatchery Facilities and Capacity

(i) Chongpyong Fish Hatchery

(1) Facilities

	Type of pond	No.of places	Water surface area (sq.meter)
1.	Water storing pond	1	14,768
2.	Winter pond	2	1,525
3.	Spawning pond (Hatchery)	18	7,326
4.	Raising pond	18	20,988
5.	Adult fish pond	3	2,435
	Total	42	47,042

(2) Production

	Year 1963	Year 1964
Quantity of spawn produced	9,800,000	5,300,000
Quantity of spawn distributed	9,800,000	5,300,000
Quantity of fingerlings produced	1,261,200	936,500
Quantity of fingerlings distributed	1,261,200	936,500

(ii) Kangwon Provincial Fish Hatchery

(1) Facilities

Type of facilities	No. of places	Size (meter)	Area(sq.m)
Raising pond	1	16 x 6	96
Trough (Atkins Method)	2	3.5 x 1	

2. Program

(a) Proposals

(i) Economical fresh water fish species will be intensively imported for culture and release to suitable reservoirs.

(ii) This development will considered in the northern area initiating at the Chongpyong reservoir.

(iii) The development effort will be put into action for five years starting in 1965.

(iv) Support from USOM/K, 8th U.S. Army and other agencies will be requested for necessary technical assistant and import of species.

(b) Organization of Guidance Activity

(i) To carry out the goals of this project, a technical guidance team will be organized with participation of Ministry of Agriculture and Forestry, the Fishery Development Office, University professors and provincial representation for the province involved.

(ii) The technical guidance team will be responsible for studies such as surveys, improvement of the areas and proper management of the hatchery for the purpose of establishing reasonable protection and maintenance of the resource.

(iii) The members of the technical guidance team will be nominated by provincial government.

3. Policy

(a) Species for stocking

(i) Suitable members of the trout family

(ii) Bass and other species considered adaptable

(b) Securing the stock

(i) Support of USOM and other agencies will be requested to secure spawn of species for propagation.

(ii) The Chongpyong Fish Hatchery and the Kangwon Fish Hatchery will be responsible for hatching of the imported spawn an canning for fingerlings under technical guidance provided by Ministry of Agriculture and Forestry and the Fishery Development Office.

(iii) Spawn import should be considered at levels of 200,000 to 500,000 per year.

(c) Facility Expansion Plan for the Kangwondo Fish Hatchery

The provincial fish hatchery expansion will be programmed on an annual bases as follows. At the completion of the project in 1971, it is estimated to be able to produce 1,000,000 fish annually.

(i) Expension of Facilities

Year	Size of Facility (sq.m)	Total * Expenses (₩)	Provincial Fund (₩)	National Subsidy (₩)	Shortage of fund (₩)
1965	140	920,000	920,000		
1966	1,063	6,745,000	1,349,000	2,022,500	3,372,500
1967	1,353	4,600,000	920,000	1,380,000	2,300,000
1968	2,900	10,730,000	2,146,000	3,219,000	5,365,000
1969	2,000	7,400,000	1,480,000	2,220,000	3,700,000
Total	7,456	30,395,000	6,815,000	8,842,500	14,737,500

Note: The above table indicates a plan of investment only for basic facilities.

(ii) Estimated Expenses of Inspection Boat Construction

Expenses	No.of Boats	Capital Needed (₩)
Construction expenses	4	** 2,120,000
Management expenses ***		1,000,000
Total	4	3,120,000

(iii) Expenses for experimental facilities, trucks and others are not presently estimated.

(d) Management of the Resource

(i) During the period of establishment of new species, fishing shall be prohibited.

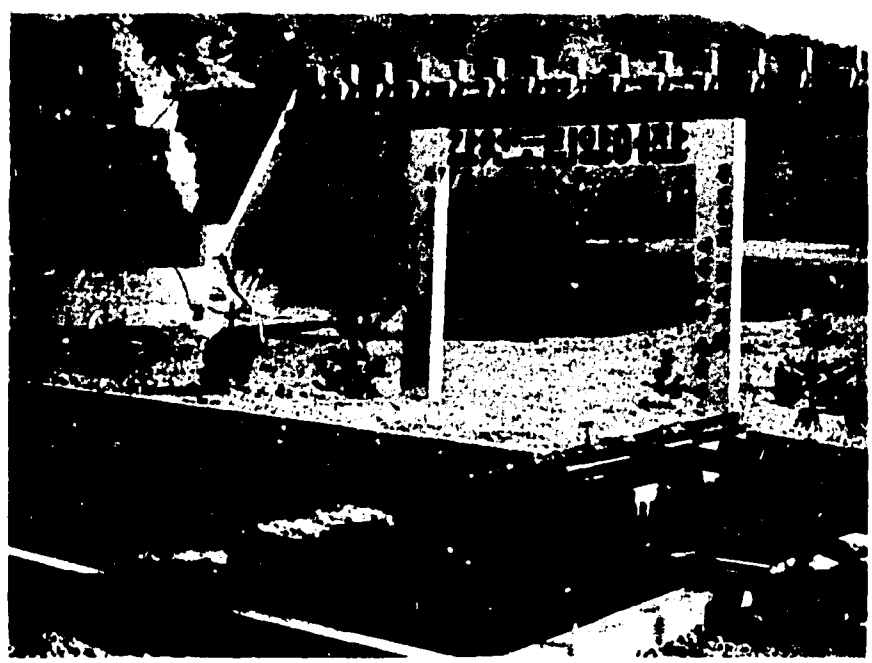
(ii) A closed season system will be employed to protect species.

(iii) Net fishing shall be prohibited.

(iv) All chemical, electric and explosive methods for fishing shall be prohibited.

(v) An inspection boat shall be dispatched to the reservoirs to check the catch and the police will be used to enforce regulations.

* $1.00 U.S. equals about 265 ₩ Korean.
** 530,000 Won per boat.
*** Annually 270 days operation covered with four hours work per day, fuel and repair charges are involved in management.



KANGWON PROVINCIAL FISH HATCHERY

(vi) Establishment of permission for fishing: Villagers and sports fisherman shall be authorized to use the reservoirs under the establishment of licence system.

(e) Organization of a Resources Management Board

To maintain the species, a culture kae* in each concerned village shall be organized. The culture kae is responsible to protect the resource in their areas.

(i) Criteria for Organization of Culture Kae's

(1) Kae's shall be formed, based on geographical considerations along the rivers and lakes.

(2) Regulation or approval of culture kae's for fresh water fish shall subject to the provincial governor's approval within the criteria established by the Ministry of Agriculture and Forestry.

(3) Programs initiated by the culture kae's shall be approved by the provincial governor.

(ii) Functions of the Culture Kae

(1) Establishment and operation of public facilities needed for the projects.

(2) Receiving of capital loans for the projects.

(3) Purchasing and distribution of special feed for the fish.

(4) Public marketing of the catch.

(5) Training in inland fisheries for the kae members.

(iii) Establishment of Special Law for Protecting Fish

It is recommended that national government establish suitable regulations which will authorize the provincial governors to establish provision for protecting the fish from possible illegal operations. Included among these will be setting closed periods for catch, identifying areas where fishing will be permanently prohibited, authorization of sports fishing licences and other neccessary matters.

* A Kae is a village Cooperative.

C. Conclusion

1. The Prospects for Fresh Water Fisheries

(a) Resource Accumulation Possible

Three years after the program is initiated, 200,000 fish will have been released to the reservoirs.

Based on the following calculations, an annual income of $67,000 will be possible; 200,000 x $\frac{1}{2}$ (mortality) x 6.75kg (minimum weight after 3 years) = 67,500 kg of the fish value will be $67,000.

(b) Promotion of Fish Culture Among Villagers

Fish culture as a source of extra income for rural people.

Long range efforts to increase fish population and the proper control of fishing will contribute to a better income for rural people. It is expected that number of farmers may be interested in this chance to make extra money.

Estimated households which will participate in fresh water fishery

	Reservoir villages		Rural households along the reservoir & river	
	No. of household	Population	No. of household	population
Yangku	428	2,130	94	306
Hwachon	520	2,080	140	700
Chunsung	843	3,793	126	596
Kapyung	96	480	24	108
Total	1,889	8,483	384	1,683

(c) Relationship with Tourist Potential

Establishment of fish in the reservoirs will attract tourists. Needs of tourists will contribute to increasing the income of rural people in the area.

2. Problems

(a) Importation of at least 200,000 spawn annually.

(b) Experimental facilities, storage for frozen feed, a truck for transportation, and inspection boats are needed.

(c) Necessary financial support for the construction of raising ponds, hatcheries and other facilities is required.